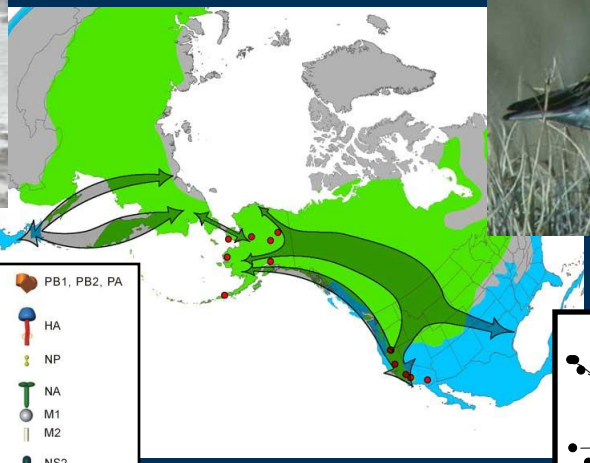
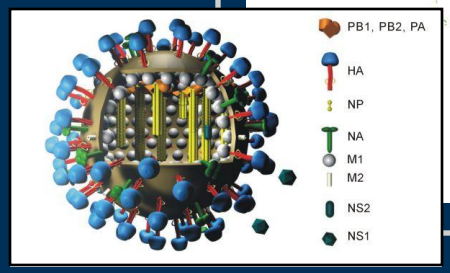
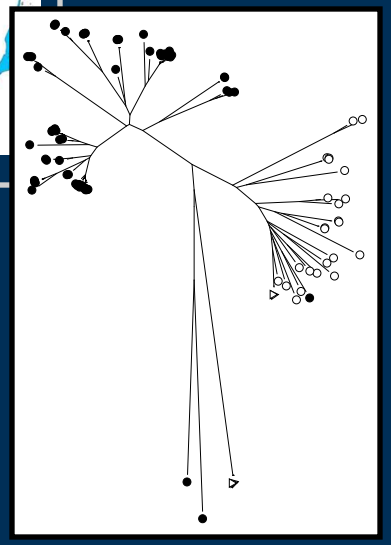
Avian influenza prevalence in Alaskan shorebirds revisited: Insights from seroprevalence samples





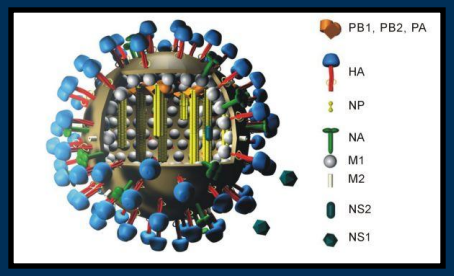


John Pearce and Dan Ruthrauff
USGS Alaska Science Center, Anchorage AK

Jeff Hall
USGS National Wildlife Health Center, Madison WI

USGS

Intercontinental movement



Virus genetic data

Prevalence data

USGS

Avian influenza sampling of target species in Alaska: rRT-PCR

	2006		2007		2008		2009		2010		Total	
	n	+	n	+	n	+	n	+	n	+	n	+
DUNL	898	2	700	0	927	0	670	0	432	0	3627	2
ROSA	173	0	265	0	272	0	217	0	101	0	1028	0
RUTU	30	0	12	0	13	0	14	0	73	1	142	1
SHAS	225	0	52	0	48	0	54	0	14	0	393	0
Total	1326	2	1029	0	1260	0	955	0	620	1	5190	3

Taken from: USFWS/USGS Progress Reports: Sampling for highly pathogenic Asian H5N1 avian influenza in migratory birds in Alaska (2006-2010 field seasons).

USGS

Avian influenza prevalence in shorebirds around the globe (rRT-PCR techniques)

Location	Samples	Prevalence	Season
Alaska: *Ip et al.*	**3,180**	**0.45%**	**Spring-Fall**
Alaska: *Winker et al.*	**1,050**	**0.0%**	**Spring**
Pacific Coast: *Iverson et al.*	**2,773**	**0.5%**	**Spring-Fall**
Pacific Coast: *Dusek et al.*	**2,010**	**0.0%**	**Spring-Fall**
South America: *D'Amico et al.*	**156**	**0.0%**	**Winter**
South America: *Douglas et al.*	**128**	**0.0%**	**Summer-Fall**
South America: *Escuerdo et al.*	**165**	**0.0%**	**Fall-Winter**
South America: Ghersi et al.	**505**	**0.7%**	**Summer-Winter**

USGS

Avian influenza prevalence in shorebirds around the globe, cont'd

Location	Samples	Prevalence	Season
Australia: *Haynes et al.*	**3,748**	**0.05%**	**Winter**
Australia: *Hurt et al.*	**173**	**15%**	**Winter**
New Zealand: *Langstaff et al.*	**801**	**0.0%**	**Fall-Winter**
Europe: *Munster et al..*	**2,924**	**0.0%**	**Various**
Europe: *Hesterberg et al.*	**748**	**0.2%**	**Spring-Fall**
South Korea: *Munster et al.*	**5**	**20%**	**?**

USGS

Delaware Bay, Eastern US

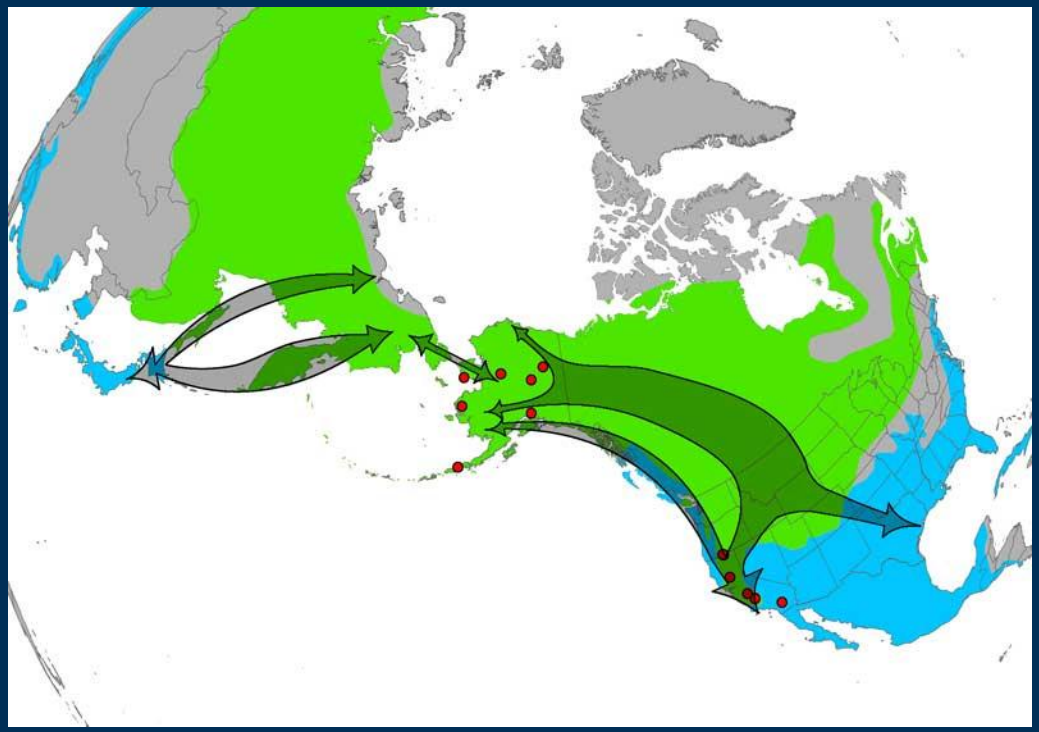
Average prevalence across 16 years = 14%

USGS

Photos by Lanny McDowell

Virus genetics:

- Limited evidence for trans-hemispheric virus gene transfer on the East Coast, but lack of positives are hindering a thorough analysis of Pacific Coast shorebirds.



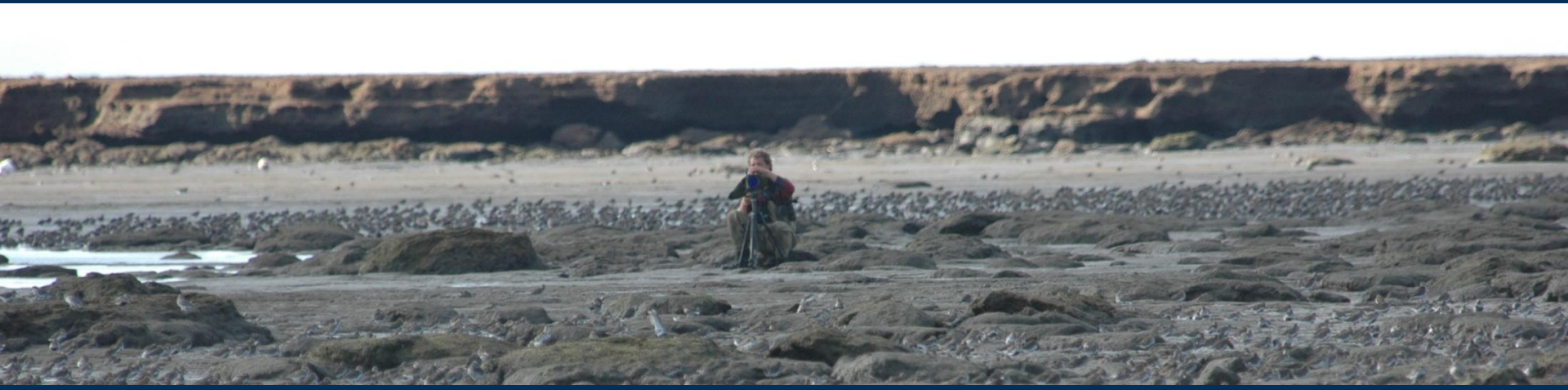
USGS

Future work using seroprevalence techniques?

USGS

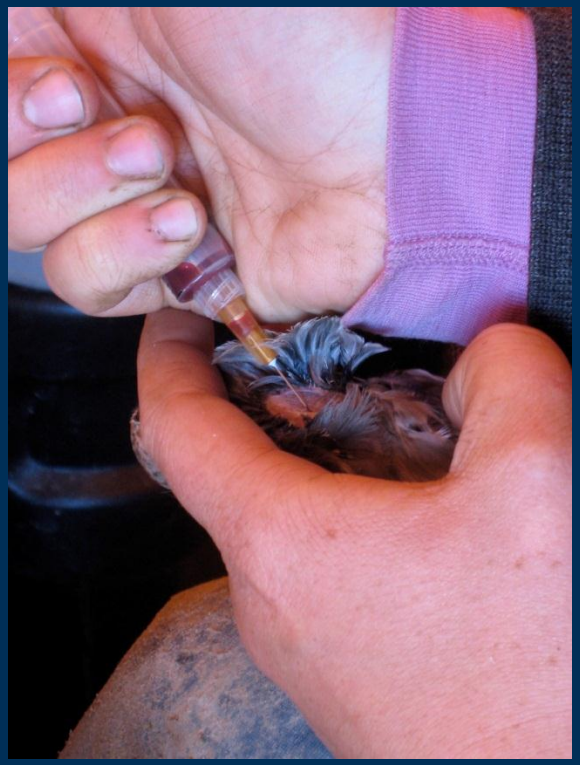
Why seroprevalence?

- Seroprevalence techniques entail sampling blood for antibodies to AI viruses
- Seroprevalence samples provide evidence of infection spanning a longer time period than rRT-PCR samples (‘historical’ infection vs. current infection)



USGS

Seroprevalence Sampling Methods



- .5 ml blood / bird from jugular
- Paired with oral / cloacal swabs using rRT-PCR analysis
- Pribilof Islands (1-16 Aug 2010), Y-K Delta (22 Aug-9 Sept 2010)
- 5 species

USGS

Dedicated focus on Ruddy Turnstones: Pribilof Islands

Whoosh net at St. George carcass dump

Special Agent Maftei

USGS

Results

Species	Site	n	Serology +
Wandering Tattler	St. George	2	0
Ruddy Turnstone	St. Paul	2	0
	St. George	51	7 (13.7%)
	Y-K Delta	5	0
Sharp-tailed Sandpiper	Y-K Delta	3	0
Rock Sandpiper	St. George	21	0
	Y-K Delta	26	0
Dunlin	Y-K Delta	153	4 (2.6%)
Total		263	11 (4.2%)

USGS

Results

Species	Site	n	Serology	n	rRT-PCR
Wandering Tattler	St. George	2	0	2	0
Ruddy Turnstone	St. Paul	2	0	0	0
	St. George	51	7 (13.7%)	51	1 (2%)
	Y-K Delta	5	0	5	0
Sharp-tailed Sandpiper	Y-K Delta	3	0	3	0
Rock Sandpiper	St. George	21	0	21	0
	Y-K Delta	26	0	26	0
Dunlin	Y-K Delta	153	4 (2.6%)	153	0
Total		263	11 (4.2%)	261	1 (0.4%)

USGS

Results

- All detections were of LPAI
- 71% (187 birds) of all samples were from AHY birds
- 5 of 7 RUTU and 4 of 4 DUNL seropositives from AHY birds

USGS

Comparison with other shorebird seroprevalence information

Species	n	% Seropositive
Ruddy Turnstone	223	65%
Red Knot	151	53.6%
Sanderling	128	3.1%
Dunlin	17	35.3%
Short-billed Dowitcher	20	5%
All samples from Delaware Bay region in May		

From: Brown et al. 2010. Prevalence of antibodies to type A influenza virus in wild avian species using two serological assays. Journal of Wildlife Diseases 46:896-911.

USGS

Delaware Bay

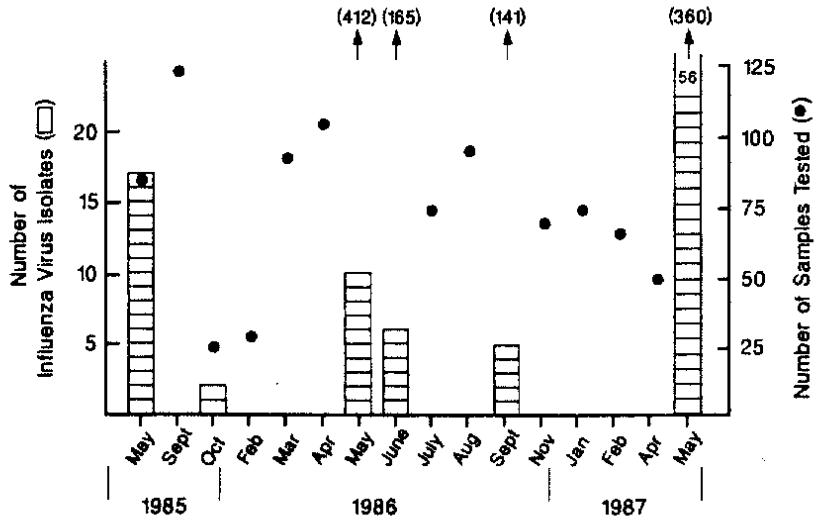


FIG. 1. Seasonal distribution of influenza A virus isolations from shorebirds and gulls.

Kawaoka et al. 1988

- What is different about the Pacific Coast?
- Timing off, missing key locations, or is prevalence really that much lower?

USGS

Acknowledgements

Shanti Davis, Mark Maftei, Callie Gesmundo, Katie Weber, Tjibbe Stelwagen, and Doug Steiner

USGS